

Hedging, Financial Distress and Managerial Risk Aversion: Evidence from Australia Gold Mining Industry

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Abstract: This study investigates risk management practices in the Australian gold mining industry. We focus on this particular industry because many firms in the sector tend to be in this single business and share a common and clear exposure to gold price volatility. We first find that the Australian companies tend to be more actively involved in gold derivative markets than their counterparts in North America. This may suggest a general risk-averse attitude among the Australian managers when comparing with the North American counterparts. Second, we find that corporate hedging activities are associated with some of firm characteristics. In contrast to the linear relationship suggested by earlier researchers, we find some empirical support for a non-linear relationship between the possibility of financial distress and hedging levels. High and low cash production costs are found to be associated with low hedging percentage, while medium level cash production cost is associated with high hedging percentage.

Keywords: Risk Management; Financial Distress; Agency Theory; Firm Leverage; Gold Mining.

1. INTRODUCTION

With the collapse of Bretton Woods, the increasing volatility rates of inflation and the wider fluctuation in the oil and commodity price since the 1970s, firms are facing an environment of unprecedented uncertainty. These risk exposures coupled with fast development of derivative markets partly due to academic researches that develop risk management techniques have given rise to the popularity and the widespread use of derivatives.

The actual corporate behaviour on hedging however is not well understood by the academic world and little is known on the consistency of the common practice with the corporate finance theories as very few empirical studies have ever been conducted. To our knowledge, the only study that investigates corporate risk management practice is by Tufano [1996] who examines the hedging practice of 48 public gold companies in North America. A large part of the difficulty of

conducting the research can be traced from the limited data in this area. Since derivatives are off-balance sheet items and are not required to report them until in recent years, corporations disclose only minimal details of their risk management programs. As a result, most empirical analyses have to rely on surveys and relatively coarse data, which impose difficulties and limitations for academics to conduct meaningful tests and thereby understand how companies engage in dynamic risk management strategies.

In this article, we extend the Tufano [1996] study by examination the hedging behaviour of Australia gold mining companies that have reported their use of derivatives in 1997. We choose Australia gold mining firms as our sample for two reasons. First, as argued by Tufano [1996] and Stulz [1996], firms in the sector tend to be in this single business and share a common and clear exposure to gold price volatility and therefore results drawn from this sample of the firms tend to be less confounded by other corporate issues. Second, Australia is the

third largest gold producer in the world and thus the size of the sample allows us to perform various tests from which we can obtain reliable results.

This study documents a few of corporate hedging behaviour. First, the Australian companies tend to be more actively involved in gold derivative markets than their counterparts in North America. This may suggest a general risk-averse attitude among the Australian managers when comparing with the North American counterparts. Second, the corporate hedging activities are associated with some of firm characteristics. In contrast to the linear relationship suggested by earlier researchers, we find some empirical support for a non-linear relationship between the possibility of financial distress and hedging levels.

The remainder of this paper is divided into four sections. Section 2 discusses the theoretical background. Section 3 discusses the data selection. Section 4 presents the empirical findings and the last section concludes the paper.

2. THEORETICAL ISSUES

2.1 Hedging and the Cost of Financial Distress

Although the concept of efficient market and diversification argue against firms creating or hedging financial exposures, Stulz [1996] pointed out that derivative usage might increase the value of the firm by reducing cash flow variations because these risks could impose real cost on the firm. Two of the major cost associates with high cash flow volatility are the cost of financial distress and the higher expected payment to corporate stakeholders.

High cash flow fluctuation can substantially raise the cost of financial distress for firms with high level of debt as the probability of payment default increases. Even without going into bankruptcy, firms under such distress can suffer under-investment problems by forgoing positive NPV projects. Hedging from the use of derivatives therefore not only reduces the expected bankruptcy costs by lowering cash flow variation but also serves as a substitute for equity capital. Numerous researchers have investigated empirical implications of this theory but the results are mixed. Mian [1996] and Nance, et al [1993] report no evidence to support the relationship between the decision on derivative usage and capital structure, Cummings, et al [1997] find weak evidence suggesting the relation. Dolde [1996], Love and Argawa [1997] confirm that high leverage firms are more likely to use derivative.

Stulz [1996] also postulates that company should adjust derivative usage according to its financial position. Companies in financial distress and in healthy position would exhibit lower hedging level. Only those companies may face financial distress would hedge more. He argues that firms that are very unlikely to fall into financial distress can take bet on managers' market view and choose a low level of hedging strategy. For companies that are already in financial distress, risk reduction is not in the interest of the stakeholders. Therefore, both types of firms will engage in low level of hedging. On the other hand, firms that are somewhere in between will choose more hedging because an unfavourable market movement will push them into financial distress. This thus suggests that financial distress does not necessarily have a linear relationship with hedging level and provides a plausible explanation that why Tufano [1996] rejects the linear relationship between firm characteristics and hedging level.

2.2 Hedging and Risk Aversion

Non-investor groups such as managers and employees have large stakes in their company, as their firm specific skills are less diversifiable. These groups unable to diversify their human capital from the exposures to their company's financial distress would require additional compensation for greater risk. The stakeholders will demand higher wages or reduce their loyalty and work efforts if the company is perceived in financial distress. By using derivatives to reduce the possibility of financial distress, company can enter into favourable contracts with these stakeholders. Studies like Breeden and Viswanathan [1990] and DeMarzo and Duffie [1992] have argued that managers may undertake hedging in an attempt to influence the labour market's perception. Stulz [1984] and Smith and Stulz [1985] also argue that derivative usage is an outgrowth of risk aversion of managers. Firms with large managerial ownership tend to hedge more as the volatility of the gold prices correlates with the volatility of managers' wealth. Consistent with these arguments, Tufano [1996] finds that derivative activities in the gold mining industry of North American are largely associated with management compensation scheme and managerial characteristics. In fact, it is the only important systematic determinant of hedging decisions where managers having more options manage less risk exposure while those with more shares have higher levels of hedging.

3. SAMPLE DESCRIPTION

Listed companies in Australian Stock Exchange classified as gold mining industry form the sample of this research. We use 1997 annual reports of these companies as our source of data because in 1997, Australian Accounting Standard Board (AASB) published a new disclosure standard for financial instruments. This standard requires detailed information to be disclosed and significantly improves comparability among companies. All annual reports used in this research are from the CD-ROM published by Connect4. 64 annual reports are available. Information related to derivative usage is collected from these annual reports. Among those 64 firms, 20 are mainly on exploration stage in 1997 financial period and no production was conducted. Another 4 companies suspended its gold production due to the falling gold price that makes their reserves not economically viable any more. This means 24 companies did not have proved or probable reserve economically viable at the end of the reporting period. This left 40 companies that were engaging in gold production as at the end of the reporting period. 5 of the 40 companies reported derivative usage, however, with no quantitative disclosure. At last, 35 companies make up the database in this research. Attempts are also made to have 1998 reports. Till the end of March 1999, only 28 companies have published their annual reports. Among these 28 companies, 18 have both reserve and disclosure of derivatives. Because of the small sample size of 1998, it is unable to use them as separate year data.

4. EMPIRICAL RESULTS

Table 1 reports summary statistics on hedging levels through derivatives by the sample firms in the financial year of 1997. Comparing with the hedging ratios in Tufano [1996], it is clear that Australian gold mining companies are more actively involved in gold derivative markets in 1997 than their competitors in North America did in 1993. Australian companies have higher value on both mean and median of hedging level. While American companies occupy higher percentage in the low hedging level groups (percentage is less than 40), Australian companies consistently have higher percentage in the high hedging level groups. Furthermore, Tufano [1996] only takes account of the three-year derivative activities scaled by the three-year production. The hedging level in this research considers all the hedging activities of the company scaled by reserves, which is the total future productions known at present. As companies are more concerned about market movement in the near future, Tufano's delta-percentage should be higher than the percentage

calculated in this research for the same company. That is, if the same measurement is employed, the gap of hedging level between American and Australian companies would be even more significant. Overall, American companies appear to be less risk averse than Australian companies. Nevertheless, most Australian companies still fall into the group of companies with low hedging level. Within the 35 companies, 22 (62.86%) have hedging levels less than 40 percent of their reserves. In terms of industry total reserves, companies having low hedging level (<40%) hold around 80% of total industry reserves. Those companies having hedging levels more than 40% of their reserve only hold 20% of the total industry reserve. This suggests that larger firms tend to hedge less than the smaller firms.

Table 1. Distribution of hedging level of Australian gold mining firms.

Firm Hedging Level	Firms	Industry Reserve	Hedging Percentage	Tufano
0	1	0.01	2.86	14.6
0.1 ~ 10	4	17.13	11.43	14.6
10 ~ 20	5	46.79	14.29	14.6
20 ~ 30	6	5.28	17.14	14.6
30 ~ 40	6	10.78	17.14	25.0
40 ~ 50	2	9.29	5.71	2.1
50 ~ 60	2	1.21	5.71	4.2
60 ~ 70	3	4.66	8.58	4.2
70 ~ 80	2	1.1	5.71	4.2
80 ~ 90	1	0.09	2.86	2.1
90 ~ 100	2	3.57	5.71	-
> 100	1	0.09	2.86	-
	35	100	100	
Mean			38.86	25.6
Medium			33	22.9
Std Dev			28.21	22.4

Note: Tufano is the distribution of the hedging percentage of North American gold mining firms examined by Tufano [1996].

4.1 Cost of Financial Distress and Shareholder Value Maximization Hypothesis

We first examine the hypothesis that derivatives may reduce the likelihood of costly financial distress, and therefore maximize the value of the shareholders as discussed in section 2. Both univariate and multivariate methods are used to test the hypothesis. Since only one company of the 35 companies in this research did not hedge in 1997 financial year, samples are divided into two groups for the univariate test: (1) companies with small hedging level (<40%) (2) companies with large hedging level (>=40%). The cut-off point at 40% is consistent with Tufano [1996]. For small sample size, Mann-Whitney U test, be used to test

the mean difference between the two groups. We also use ordinary least square regression and include size and cash position as control factors to test the following model:

$$\text{Hedratio} = \alpha + \beta_1 \text{cash cost} + \beta_2 \text{leverage} + \beta_3 \text{cashpos} + \beta_4 \text{size} + \xi \quad (1)$$

Where

Cashcost includes all direct and indirect costs of mining. It excludes noncash items such as depreciation, depletion, and amortization..

Leverage is defined as total liability scaled by total assets

Cashpos is the percentage of cash in terms of total assets

Size is the annual average of weekly market value of equity.

Table 2 reports the results for the both tests. In panel A for the multivariate test, all factors display the same sign as priors. However, only leverage is marginally significant at less than 10 percent level. Quite surprising, we did not find cash production cost has any effect on the level of hedging. The univariate test in Panel B tells a similar story. The low hedging group has lower mean rank in cash production costs and leverage but the differences of the factors between the two groups are not significant. Even when we omit cash position in the test to reduce the possible correlations among independent variables, it is still unable to conclude that the two groups are different. Overall, our findings are consistent with those of Tufano [1996] which rejects the shareholder maximization hypothesis.

We examine the level of hedging and cost of financial stress further by investigating whether they exhibit nonlinear relationship as postulated in the second set of hypothesis. We divide the sample into three groups according to firm characteristics rather than hedging level. All companies are ranked in terms of cash production cost and leverage separately and then stratified in quartiles. The first quartile of each ranking is grouped as companies with strong financial position. The last quartile of each rank is grouped as companies with high possibility in distress. The remaining companies are in the medium position. A Kruskal-Wallis test is conducted for this hypothesis.

Contrary to Stulz [1996], we did not find any evidence supporting the hypothesis with respect to leverage. Table 3 shows that the hedge ratio is linearly proportion to the level of leverage where firms with lower hedging ratios consistently embrace lower leverage among the three groups.

This positive relationship is consistent with Tufano [1996] when using the pooled data and Love and Argava [1997]. However, when examining the relationship between hedge ratio and cash cost, we find that firms with high and low cash costs hedge less than those with medium cash costs. Companies with medium cash production costs in the industry have considerably high mean value (0.505) and high rank hedging ratio (21.24) when comparing with companies with low (0.244) or high (0.304) cash production costs. The difference is significant at 10% level.

Table 2. The effect of financial distress on firm hedging.

Panel A: OLS Test					
Dependent Variable: Hedratio					
Constant				0.111 (0.254)	
Cash Cost				2.780E-05 (0.001)	
Cashpos				0.430 (0.358)	
Leverage				0.486 (0.280)*	
Size				3.306E-11 (0.000)	
R squared				0.121	
Panel B: Mann-Whitney U Test					
	Low Hedging Level (< 40%)		High Hedging Level (>= 40%)		
	N	Mean	N	Mean	p value
Hedratio	21	0.207 (0.116)	13	0.696 (0.198)	
Cash Cost	21	346.8 (115.6)	13	378 (66)	0.381
Leverage	22	0.352 (0.193)	13	0.396 (0.195)	0.533

Note: * denotes significantly different from zero at 10% level. The standard errors and standard deviations are reported in parentheses in Panel A and B respectively.

Our result suggests that managers maybe using cash production cost rather than leverage to monitor the likelihood of financial distress when deciding hedging strategy. One possible reason relates to the purpose of derivative usage. As derivatives are used to manage cash flows, variable costs act as a direct standard for hedging contracts. Companies with high cash costs but still below spot price are likely to fall into financial distress if market price moves unfavourably. They are more inclined to fix selling price above costs to a certain extent as suggested by Stulz.

Furthermore, the difference between cash production costs and gold market price serves as an indicator for future production. Tufano [1997] points out gold mining companies hold a call option of gold, with the exercise price being their marginal production costs (cash production costs). For example, when the gold price falls below

marginal costs, the firm can choose to temporarily or permanently suspend production. In this sense, cash production costs determine the maximum volume (future production economically viable) and minimum exercise price (marginal production cost) of hedging contracts. Another explanation relates to accounting standard in Australia. The standard requires mining companies to write off deferred exploration and development costs from assets for reserves not economically viable any more. A large reduction in book values of a company may signal to the market that the company is in financial distress. Fixed price through derivatives could maintain reserves economically viable even when market price moves to an unfavourable direction. Thus, hedging is more compelling for companies having cash production costs close to market spot price. By contrast, leverage is a noisy signal to market for possible financial distress, especially for equity market. In share market, some high return companies actually have high leverage.

Table 3. The nonlinearity test between cost of financial distress and firm hedging

Panel A: Hedge ratio and Leverage			
Leverage	N	Mean	Mean Rank
1	9	0.358 (0.376)	15.11
2	18	0.361 (0.221)	17.94
3	8	0.484 (0.304)	21.38
Total	35		
Chi-square	1.584 (0.453)		

Panel B: Hedge ratio and Cash Production Cost			
Cash Cost	N	Mean	Mean Rank
1	9	0.244 (0.173)	12.56
2	17	0.505 (0.312)	21.24
3	8	0.304 (0.249)	15.13
Total	34		
Chi-square	5.066 (0.079)*		

Note: * denotes significantly different from zero at 10 percent level. The standard deviations are reported in the parentheses.

4.2 Managerial Risk Aversion

Base on agency theory, it is argued that managers whose human capitals are poorly diversified would prefer managing risk in the best interests of themselves rather than those of shareholders. We test the hypothesis that managers with greater share ownership would prefer higher hedging level,

whilst managers with greater share options would employ less derivative usage. This is because shares provide linear payoffs as a function of stock prices whereas options provide convex payoffs. To some extent, this hypothesis is also consistent to the academic argument that derivatives reduce agency cost between management and shareholders. As in section 4.1, we run OLS regression and Mann-Whitney U test for the following equation:

$$Hedratio = \alpha + \beta_1 shares + \beta_2 options + \xi \quad (2)$$

Where

shares is the log of the value of common shares owned at average annual share price,

options is the number of options held by directors.

Both tests in table 4 show that none of the variables are statistically significant in explaining the amount of hedging in the firms. Our results therefore differ from those of Tufano [1996] with respect to the Managerial Utility Maximisation Hypothesis. He found evidence that managers' share and option holding are associated with the degree of risk management. This difference could be due to cross ownership between Australian gold companies. The cross holding enable directors in one company to sit in boards of other companies although they do not have direct interest (share or option holding) in other companies. Indirect ownership is usually not disclosed in annual report. Thus, directors' interests disclosed in annual reports may not reflect their real interests involved in the company, and hence, distorts our results.

Table 4. Managerial risk aversion on firm hedging.

Panel A: OLS Test				
Dependent Variable: Hedratio				
Constant		0.824	(0.461)	
Shares		2.89E-02	(0.034)	
Options		1.65E-08	(0.000)	
R squared		0.093		

Panel B: Mann-Whitney U Test				
	Low Hedging Level (< 40%)	High Hedging Level (>= 40%)		
	N	Mean	N	Mean
Hedratio	21	0.207 (0.116)	13	0.696 (0.198)
Shares	20	14.92 (2.21)	10	13.68 (3.08)
Options	17	2283587 (3596345)	10	1231231 (1083554)
				p-value
				0.397
				0.98

Note: The standard errors and standard deviations are reported in the parentheses in Panel A and B respectively.

5. CONCLUSION

This paper investigates corporate hedging activities by using data from gold mining industry in Australia. We find that Australian companies in 1997 are more actively involved in gold derivative markets than their counterparts in North America in 1990 to 1994. This may suggest a general risk-averse attitude among Australian managers when comparing with North American managers.

The corporate hedging activities are also associated with some of firm characteristics, however, in different patterns. In contrast to the linear relationship suggested by previous researches, we provide evidence supporting non-linear relationship between the possibility of financial distress and hedging levels. High and low cash production costs are found to be associated with low hedging percentage, whilst medium level cash production cost is associated with high hedging percentage. However, not all indicators of financial distress act in this non-linear pattern. We find no evidence to support the non-linear relationship between leverage and hedging level.

The results we find in this study allow us to draw the inference that corporate may use derivatives as part of operation decisions. Derivative could be used to complement the call option a gold mining company already has on its operation. By using derivatives, company can maximise its production and minimise possibility of financial distress. From this point, derivatives differ themselves from a pure finance activity such as changing leverage that virtually have no impact on production.

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